AMS - 456

AN IMPROVED DUMP PIT

FOR RECEIVING FARMERS STOCK PEANUTS

U. S. DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
Transportation and Facilities Research Division
in cooperation with
UNIVERSITY OF GEORGIA
College of Agriculture Experiment Stations

Growth Through Agricultural Progress

PREFACE

This interim report, on the design of an improved dump pit and related pit facilities for receiving farmers stock peanuts at commercial warehouses, is part of a research project covering improved work methods and equipment for handling farmers stock peanuts. The broader objective is to cut costs and improve efficiency in marketing farm products.

The work on peanuts is under the supervision of Leo E. Holman of the Agricultural Marketing Service. Operators of peanut warehouses made their facilities available for the study.

The studies were conducted in cooperation with the University of Georgia Agricultural Experiment Stations.

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SUMMARY

An improved dump pit for receiving farmers stock peanuts is described and discussed in this report. Savings in labor, amounting to as much as 44 cents per 4-ton truckload of peanuts received, plus a significant reduction in damage to peanuts during the receiving cycle, can be achieved with this improved dump pit and receiving method.

Equipment and time studies were made at dump pits in use in 1960. These pits were found to be primarily lacking in capacity, resulting in considerable spillage of peanuts around the pit. Thus, many peanuts were damaged by being stepped upon, shoveled from trucks, and run over by trucks. Also, unduly high labor requirements were inherent in the method of receiving used with these pits. Crews of one, two, and three men are compared as to labor requirements and costs for receiving a 4-ton truckload.

Detailed drawings are shown for constructing the improved dump pit as an integral unit from steel. The pit can also be constructed of concrete.

BACKGROUND

Two important factors in designing a dump pit for receiving farmers stock peanuts by truck at commercial storage warehouses are (1) the damage done to peanuts during receiving, and (2) the labor involved in the receiving operation.

Broken peanuts permit increased insect activity, reducing the value of the peanuts. Labor costs should be held to a minimum to provide effective and less costly warehouse service to the peanut producer.

Generally, peanuts are received in bulk at Southeastern warehouses, but occasionally some are received in 100-pound bags. Only bulk peanuts are considered in this report. Almost every type of truck is used to deliver the peanuts to the warehouses, but in this discussion the average size of a truckload of bulk peanuts is considered to be 4 tons.

Dump pits and bucket elevators are commonly used in the Southeast for receiving bulk peanuts at commercial warehouses. However, many of the dump pits (those typical of the pits observed in operation between 1958 and 1961) and related pit facilities were inadequate for efficient operation.

In this report, an improved dump pit and related pit facilities are described and discussed, along with an improved receiving method which minimizes the damage to peanuts and the labor costs. Labor requirements and costs for the improved pit are compared with those for the prevalent type of pit.

Observations of handling methods, equipment, and practices were made in 17 warehouses, and time studies of selected operations were made in 13 warehouses. The labor requirements for receiving farmers stock peanuts by the methods described were determined through conventional time-study procedures. Wage rates used are based on those reported to have been paid during the 1960 season in some sections of the Southeast. The estimated construction costs given for the improved dump pit are based on labor and material prices obtained in April 1961 from suppliers at Athens, Ga.

The work involved in receiving peanuts by dump pit consists of (1) positioning the truck on the hoist, (2) opening the endgate, (3) hoisting the front end of the truck to allow peanuts to flow by gravity into the pit, (4) removing the remaining peanuts by shovel from the truckbed, (5) lowering the truck, (6) closing the endgate, (7) moving the truck off the hoist and leaving the pit, and (8) cleaning and sweeping up around the pit.

PREVALENT DUMP PITS

The studies showed several shortcomings in the prevalent type of pit, which prevent efficient receiving operations. The major shortcomings noted were (1) poorly designed pits with too little capacity, and (2) inadequate related pit facilities.

Pit Capacity and Design

The capacity and design of the pit have a direct bearing on both the amount of peanut damage and the labor requirements. A pit that is too small, both in volume (about 1 ton or less) and in grate area (35 square feet or less), allows peanuts to overflow on all sides of the pit opening. Many of these peanuts are stepped on by the receiving crew (fig. 1) or crushed by trucks running over them.

The prevalent type of pit (fig. 2) was not designed to be self-cleaning (some peanuts do not slide out of the pit, but cling to the sides). This is important because of the many varieties and lots of peanuts that must not be commingled.

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Figure 1.--Peanuts are crushed when stepped on around small overflowing pits.

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Figure 2.--A prevalent type of dump pit.

When the pit is too small and not self-cleaning, the labor required to clean up peanuts in and around it increases. Unproductive time increases as the crew waits while the pit partially empties before the unloading of a truck can be completed (fig. 3).

Related Pit Facilities

Related pit facilities include the truck hoist, pit shelter, pit runways and approach drives, and a sheltered waiting area for loaded trucks. The first three items influence the labor required to receive a truckload of peanuts and the last the damage factor.

Many of the truck hoists studied required excessive time for properly positioning the truck for hoisting, and had slow lifting rates. Also, the clearance of the pit shelters was not sufficient to allow the truckbeds to be hoisted enough (35 degrees) for a complete gravity flow of peanuts from the truck into the pit. Shoveling, causing additional damage, was then necessary to complete the unloading.

Pit runways and approach drives were not designed for a rapid and uncongested flow of trucks to, over, and away from the pit. Sometimes a delay occurred when a truck stalled on an inclined approach to a pit runway.

Sheltered waiting areas for loaded trucks play an important part in customer service and goodwill. A producer often will drive a few extra miles to a warehouse that has a sheltered waiting area. Then, if it rains, he will not be concerned with damage to his peanuts by water, or bothered with placing a cover over the peanuts (fig. 4).

The Receiving Crew

The receiving crew had a high percentage of unproductive time when unloading peanuts with the prevalent type of dump pit and facilities (table 1). The crew size varied, but usually either two or three workers were used. The labor requirements and the crew organizations are shown in tables 1 and 2. A two-man crew was unproductive 63 percent of the time, while a three-man crew was unproductive 73 percent of the time. Productive times were the same whether using a two or a three-man crew. The unproductive labor increased significantly when a third worker was added.

IMPROVED DUMP PIT

The improved dump pit described in this report (figs. 5 and 6) was designed to cause the least possible damage to the peanuts in the receiving cycle, and to receive with optimum labor requirements.

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Figure 3.--Unproductive labor while the prevalent type of dump pit empties.

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Figure 4.--An unsheltered and congested waiting area.

Table 1.--Labor requirements for receiving a 4-ton truckload of farmers stock peanuts, using the prevalent dump pit method with a 2-man crew 1/

Time item	Productive time	Unproductive time	Total
	Man-minutes	Man-minutes	Man-minutes
Position truck on cradle hoist	-	.92	.92
Open full-width endgate	.16	-	.16
Raise truck	1.06	1.06	2.12
Gravity flow of peanuts into pit	-	8.66	8.66
Shovel and cleanup	5.00	-	5.00
Lower truck	.55	.55	1.10
Close endgate	.16	-	.16
Truck leaves dumping position	-	.52	.52
Total	6.93	11.71	18.64
Percent of total time	37.00	63.00	100.00
Elapsed minutes 9.32			

1/ Crew organization: Two workers wait while the truck is properly positioned for dumping. Both workers open endgate, one worker operates the hoist to raise the truck while other worker waits. Both workers wait while peanuts flow from truck. Both workers shovel remaining peanuts from truck and cleanup area around pit. One worker lowers truck while the other worker waits. Both workers close endgate and wait while empty truck leaves dumping position.

Table 2.--Labor requirements for receiving a 4-ton truckload of farmers stock peanuts, using the prevalent dump pit method with a 3-man crew 1/

Time item	Productive time	Unproductive time	Total
	Man-minutes	Man-minutes	Man-minutes
Position truck on cradle hoist	-	1.38	1.38
Open full-width endgate	.16	.08	.24
Raise truck	1.06	2.12	3.18
Gravity flow of peanuts into pit	-	13.00	13.00
Shovel and cleanup	5.00	-	5.00
Lower truck	.55	1.10	1.65
Close endgate	.16	.08	.24
Truck leaves dumping position	-	.78	.78
Total	6.93	18.54	25.47
Percent of total time	27.00	73.00	100.00
Elapsed minutes. 8.49			

1/ Crew organization: Three workers wait while truck is properly positioned for dumping. Two workers open endgate. One worker operates the hoist to raise the truck while two workers wait. Three workers wait while peanuts flow from truck. Three workers shovel remaining peanuts from truck and cleanup area around pit. One worker lowers truck, two workers wait. Two workers close endgate of truck while one worker waits. Three workers wait while empty truck leaves dumping position.

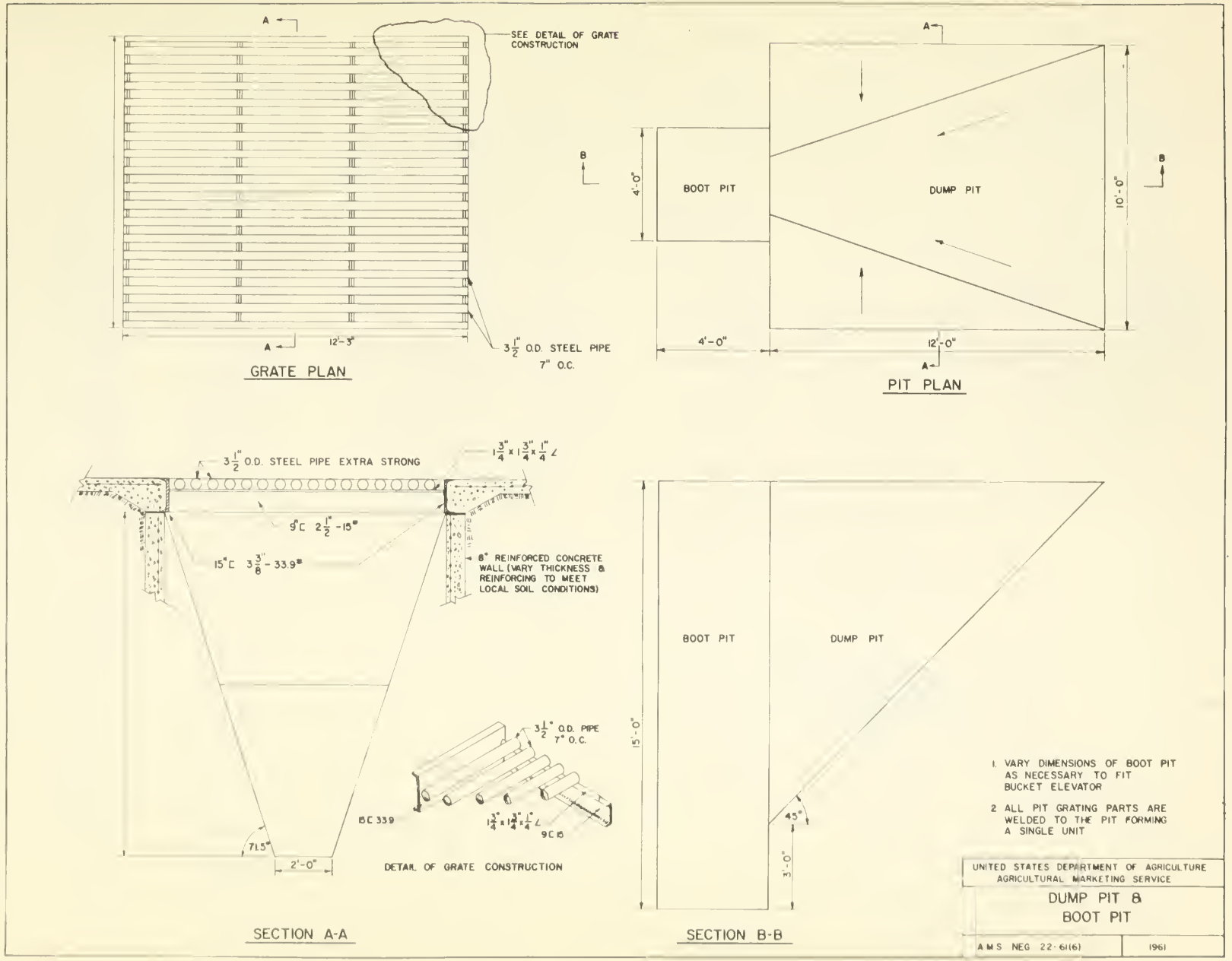

Figure 5.--Construction details for the improved dump pit and boot pit and grate.

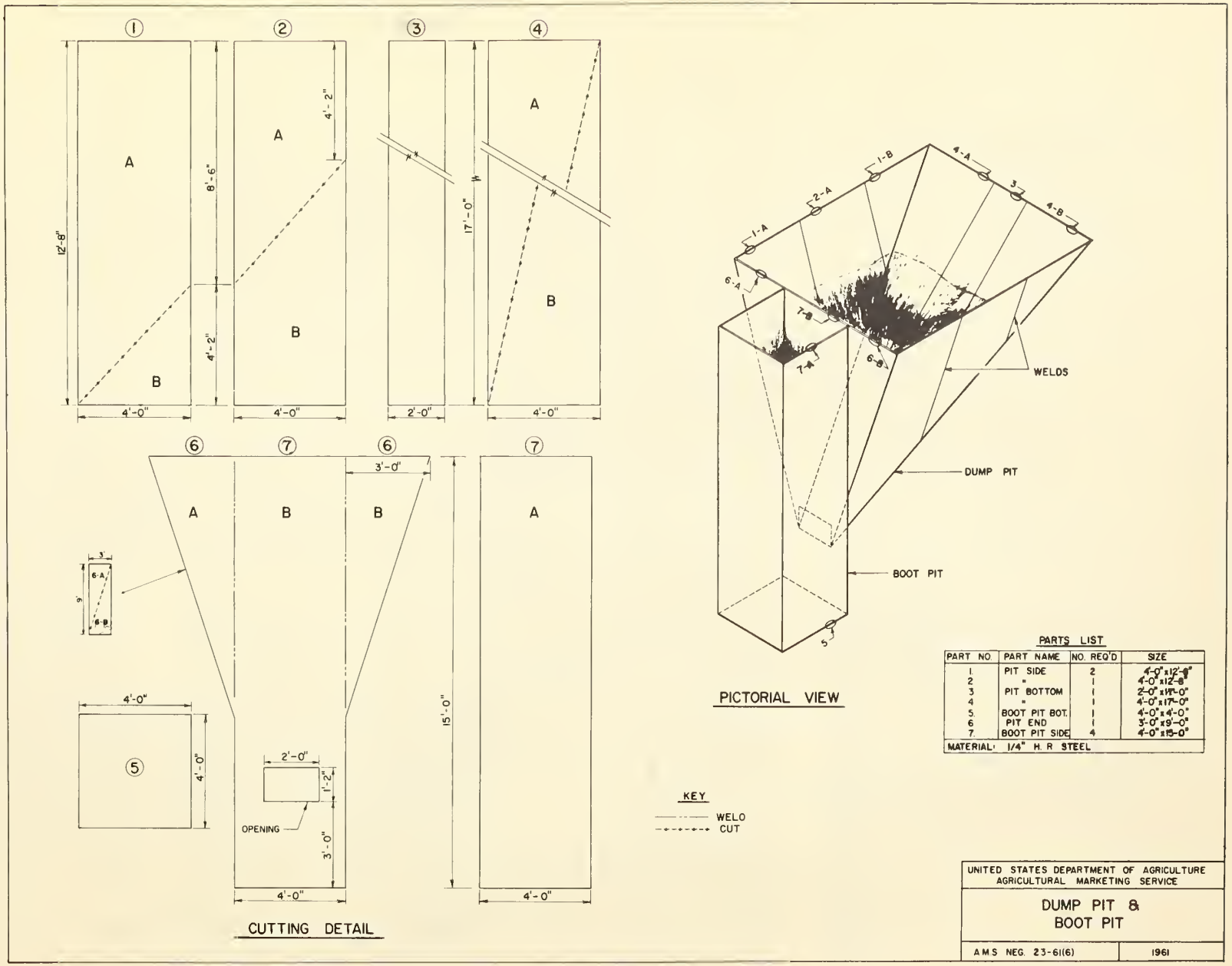

Figure 6.--Cutting detail for the improved dump pit and boot pit. There is little waste where steel plates of standard lengths and widths are cut and welded as shown.

Pit Capacity and Design

The improved pit is designed to hold from 4 to 5 tons of peanuts, depending on the variety. It is based on the principle that the pit should hold slightly more than the average size of load received. The pit is large enough that the receiving crew does not have to wait for it to partially empty before completely unloading a truck. The pit has a grate area of 10 feet by 12 feet, which allows for the complete gravity flow of peanuts from the truck into the pit with minimum spillage. The sides and valley angle of the pit are sloped so as to provide for complete self-cleaning. 1/

The pit shown in figures 5 and 6 is constructed of steel, with the receiving pit and the elevator boot pit an integral unit, making it completely watertight. The size of the boot pit allows easy access for maintenance of the elevator boot. Concrete may be used for constructing this improved pit, using the same basic dimensions as those given for the steel pit. Sound concrete construction standards must be observed for best results.

Figures 5 and 6 give construction details for the improved pit where steel plates of standard lengths and widths are used. Little waste results when the plate is cut and welded as shown in figure 6. All seams and joints are electrically arc welded to form the integral watertight unit.

In 1961, the estimated cost of constructing the improved dump pit of steel is:

5,400 pounds of 1/4-inch plate.....	$ 650.00
40 feet of 1-3/4-inch by 1/4-inch angle iron.....	10.00
2 lengths, 12-foot, 3-inch, of 15-inch channel, 33.9 pounds per foot.....	75.00
4 lengths, 9-foot, 9-inch, of 9-inch channel, 15 pounds per foot.....	50.00
16 lengths, 12-foot, 3-inch, by 3-1/2-inch O. D. extra strong steel pipe (pit grate).....	250.00
Cutting and welding.....	100.00
Total.....	$ 1,135.00

The clearance of the pit shelter should be 15 feet. The hoist used to raise the front of the truck should operate at a lifting speed of 20 feet per minute. This allows a truckbed to be raised to an incline of 35 degrees which, observations show, is sufficient for a complete gravity flow of dry peanuts into the pit.

The runways should be level with the top of the pit for 20 feet on each side of the pit. The approaches to the runways should be smooth and gradual, permitting rapid movement of trucks to and from the dumping position.

1/ Bouland, H. D., and Smith, L. L., "A Small Country Elevator for Merchandising Grain." Mktg. Res. Rpt. No. 387, U. S. Dept. Agr., June 1960.

A sheltered area should be provided for waiting loaded trucks. An area 30 by 40 feet, with an overhead clearance of at least 12 feet, providing parking space for six trucks is recommended.

Figure 7 shows a suggested layout of a complete peanut receiving facility.

The Receiving Crew

The improved dump pit method requires only a single worker. Labor requirements are shown in table 3. The reduction in labor results primarily from properly inclining the truck, which permits a complete gravity flow of the peanuts into the pit. This eliminates the shoveling and cleanup part of the operation required in the prevalent dump pit. The work done with the improved dump pit method is less fatiguing than in the prevalent type of pit, permitting a better day's performance by the worker. Although 70 percent of the total time required to perform the receiving operation is unproductive, there is still a significant cost reduction when using a single worker. Comparative labor costs for three crew sizes are shown in table 4.

Table 3.--Labor requirements for receiving a 4-ton truckload of farmers stock peanuts, using the improved dump pit method, with a one-man crew 1/

Time item	Productive time	Unproductive time	Total
	Man-minutes	Man-minutes	Man-minutes
Position truck on cradle hoist	-	.35	.35
Open full-width endgate	.22	-	.22
Raise truck	.46	-	.46
Gravity flow of peanuts into pit	-	2.50	2.50
Lower truck and close endgate	.62	-	.62
Truck leaves dumping position	-	.26	.26
Total	1.30	3.11	4.11
Percent of total time	29.00	71.00	100.00
Elapsed minutes	4.41		

1/ Crew organization: Worker waits while the truck is properly positioned for dumping. Worker then opens endgate. He then operates the hoist to raise the truck. Worker waits while the peanuts flow into the pit. He then lowers the truck and closes the endgate. Worker waits while the truck leaves dumping position.

Table 4.--Comparative labor costs and requirements for receiving a 4-ton truckload of farmers stock peanuts using the prevalent type of pit and the improved pit 1/

Type of pit	Crew size	Labor required	Cost per load
	Number	Man-minutes	Dollars
Prevalent	2	18.64	0.39
Prevalent	3	25.47	.53
Improved	1	4.41	.09

1/ Based on an assumed labor cost of $1.25 per hour.

RELATED CONSIDERATIONS

Several related considerations must be taken into account if the receiving operation is to be performed adequately. First, the sampling and grading of each truckload of peanuts must be done rapidly and accurately so as not to hinder the receiving operation. Second, the bucket elevator used to move the peanuts from the pit must be able to operate at a rate of at least 60 tons per hour. A future report will deal with correct elevator speeds, bucket spacing, and other information which will promote efficient elevator operation.

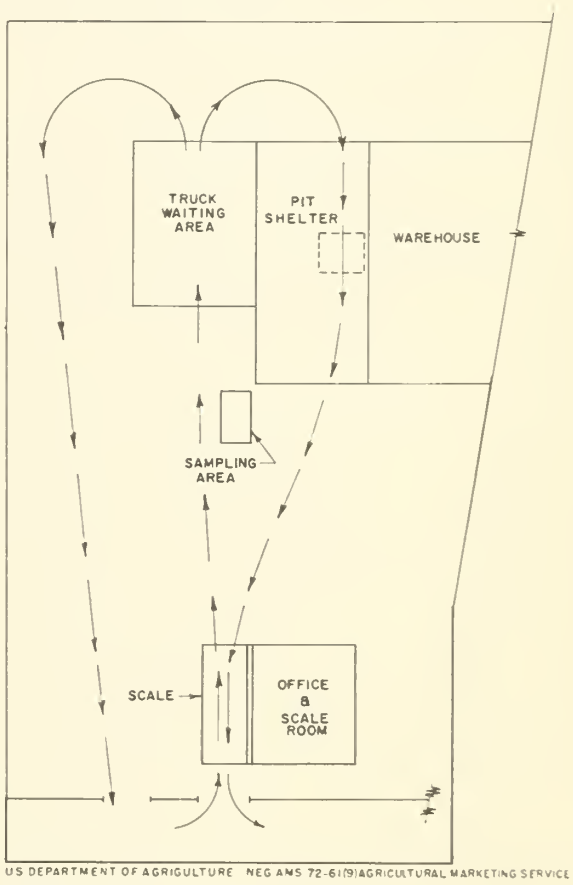

Figure 7.--Suggested layout of a peanut receiving facility. A sheltered waiting area for loaded trucks and a shelter over the dump pit are specified.